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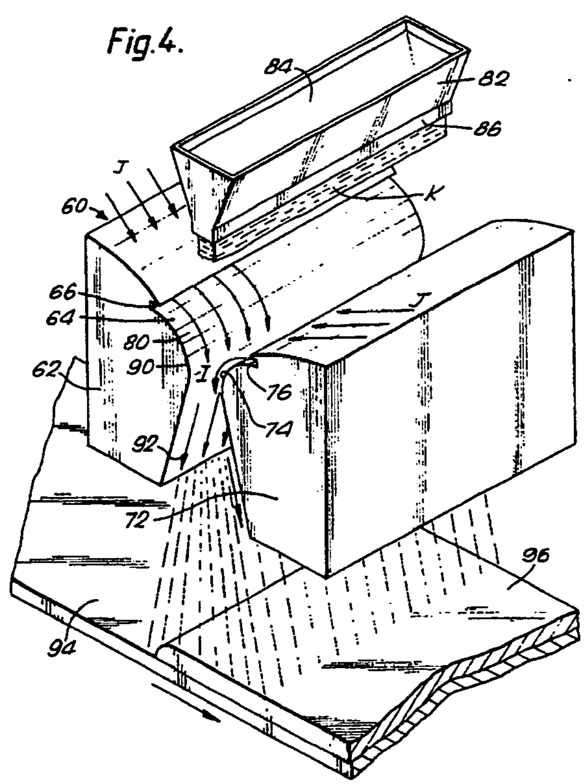
(54) **An apparatus and method for atomising a liquid.**

(57) An apparatus for atomising a liquid comprises an annular housing (32) which has a radially inner curved annular Coanda surface (34). The housing (32) has an outlet (40) in its radially inner circumferentially extending side which supplies a first pressurised fluid onto the Coanda surface (34). Diametrically opposite, confronting, surface portions (31,33) of the Coanda surface (34) define a convergent/divergent passage (35,37,39). A liquid is discharged from a nozzle (42) into the convergent portion (35) of the convergent/divergent passage so that a stream of liquid is positioned between the confronting surface portions (32,33). A second fluid is entrained by the first fluid flowing over the Coanda surface (34). The second fluid flows between the first fluid and the stream of liquid, and the liquid is atomised as it interacts with the flow field generated by the apparatus. The liquid stream is automatically centralised between the confronting surface portions (31,33) to give uniform atomisation.

Fig.4.



EP 0 444 767 A2

The present invention relates to an apparatus and method for atomising a liquid, and in particular to an apparatus or method in which a molten metal is atomised by fluid to produce metallic particles or droplets.

It is well known in the art to produce molten or semi-molten metallic droplets by an atomising fluid, and to either deposit the metallic droplets onto a substrate to produce a metallic article, or to deposit the metallic droplets onto an article to produce a coated article. British patent GB1379261 discloses an apparatus and method for producing metallic articles in which the molten metal is atomised by jets of gas directed at a flow of molten metal. British patent GB2146662B discloses an apparatus and process for producing metallic articles in which a first gas stream flows over a Coanda surface, a second gas stream is entrained by the first gas stream, and a molten metal is atomised by flowing the molten metal between the two gas streams.

A prior art apparatus for atomising a liquid comprises a Coanda surface means to supply a first fluid to the Coanda surface such that the first fluid flows along the Coanda surface and liquid supply means to supply liquid.

A problem associated with the prior art apparatus and process described in GB2146662B is that there are varying amounts of atomisation of the molten metal depending upon the relative positions of the molten metal flow and the Coanda surface. In an optimum position in which the molten metal flow is adjacent the Coanda surface, and the flow of gas over the Coanda surface, the process atomises the molten metal uniformly and consistently. However if the molten metal flow is not in the optimum position relative to the Coanda surface, the uniformity of atomisation of the molten metal flow changes because there are changes in the relative proportion of droplets or particles of particular sizes. It is difficult to consistently arrange for the molten metal to be in the optimum position relative to the Coanda surface, and hence it is difficult to ensure that the atomisation is consistent.

The present invention seeks to provide an apparatus and method for producing liquid particles or droplets using Coanda surfaces in which more uniform atomisation of the liquid is achieved.

Accordingly the present invention provides an apparatus for atomising a liquid comprising first and second confronting Coanda surfaces, the first and second Coanda surfaces being arranged to define a flow passage having at least a convergent portion, means to supply a first fluid to the first and second confronting Coanda surfaces in the convergent portion of the flow passage such that the first fluid flows along the first and second confronting Coanda surfaces through the flow passage, a liquid supply means being arranged to supply liquid to the flow passages such that in use the liquid is atomised to form liquid particles or droplets as it flows through the flow passage.

Preferably a second fluid is caused to flow between the first and second confronting Coanda surfaces through the flow passage by the flow of first fluid along the first and second confronting Coanda surfaces such that the second fluid flows between the flow of first fluid and the liquid.

The first and second Coanda surfaces may be shaped to form a second parallel portion of the flow passage immediately downstream of the first portion.

The first and second Coanda surfaces may be shaped to form a third divergent portion of the flow passage immediately downstream of the second portion.

Preferably the first and second Coanda surfaces may be shaped to form a second divergent portion of the flow passage immediately downstream of the first portion.

The first and second confronting Coanda surfaces may be elongate in a direction transverse to the direction of the fluid flow and preferably are parallel linear surfaces. The first and second confronting Coanda surfaces may be surface portions of a single circumferentially extending Coanda surface. The first and second confronting Coanda surfaces may be parallel linear Coanda surface portions of a single polygonal Coanda surface.

The supply of liquid may be a supply of molten metal liquid fuel, water, paint or any surface treatment material. The means to supply the first and second fluids may be supplies of fluids inert or reactive with respect to the molten metal, air or oxygen.

A substrate may be arranged to receive the metallic droplets leaving the flow passage, the metallic droplets are deposited onto the substrate to produce a metallic article, the metallic droplets are in a liquid or partly solidified state when deposited on the substrate.

An article may be arranged to receive the metallic droplets leaving the flow passage, the metallic droplets are deposited onto the article to produce a metallic coating, the metallic droplets are in a liquid or partly solidified state when deposited on the article.

The present invention also provides a method for atomising a liquid comprising directing a first fluid into a convergent portion of a flow passage to flow along first and second confronting Coanda surfaces defining the flow passage towards an end of the convergent portion having the smallest cross-sectional area, supplying a liquid to the flow passage such that the liquid is atomised to form liquid particles or droplets as it flows through the flow passage.

Preferably causing a second fluid to flow between the first and second confronting Coanda surfaces through the flow passage by the flow of first fluid along the first and second confronting Coanda surfaces such that the second fluid flows between the flow of first fluid and the liquid.

The present invention will be more fully described by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a sectional view through a prior art apparatus for atomising molten metal to produce metallic particles or droplets using a Coanda surface.

Figure 2 is a sectional view through an apparatus according to the present invention for atomising a liquid using Coanda surfaces.

Figure 3 is a perspective view of one embodiment of an apparatus according to the present invention.

Figure 4 is a perspective view of a second embodiment of an apparatus according to the present invention.

Figure 5 is a sectional view through a further embodiment of an apparatus according to the present invention.

A prior art apparatus 10 for atomising a molten metal to produce metallic particles or droplets is shown in Figure 1. The apparatus 10 comprises a housing 12, one side of which has a curved Coanda surface 14. The housing 12 defines a chamber 16 which is arranged to receive a first pressurised fluid supplied by a pipe 18. The housing 12 has an outlet 20 which supplies the first pressurised fluid onto the Coanda surface 14.

A tundish 22 contains a supply of molten metal 24, and the tundish 22 has a nozzle 26 at a lower region to discharge molten metal. The tundish 22 is arranged at a higher elevation than the Coanda surface 14 and the nozzle 26 is arranged such that a stream of molten metal C falling from the tundish 22 is adjacent the Coanda surface 14.

The first fluid is discharged from the chamber 16 through the outlet 20 at high velocity and attaches to the curved Coanda surface 14, as shown by arrows A. The flow of the first fluid over the Coanda surface 14 causes a second fluid to be entrained towards the Coanda surface 14, as shown by arrows B. The stream of molten metal C is positioned between the flow of the first fluid and the flow of the second fluid, and is atomised at a point of intersection of the two fluid flows to produce metallic particles or droplets.

As discussed previously the uniformity of atomisation of the molten metal is dependent upon the relative positions of the molten metal flow and the Coanda surface. If the stream of molten metal C is not adjacent the Coanda surface 14 the uniformity of atomisation of the molten metal varies with increasing distance from the optimum position.

An apparatus 30 for atomising a liquid according to the present invention is shown in Figure 2. The apparatus 30 comprises an annular housing 32, the radially inner circumferentially extending side of which has a curved circumferentially extending Coanda surface 34. The annular housing 32 defines an annular chamber 36. One or more pipes 38 are arranged to supply a first pressurised fluid into the annular chamber 36. The annular housing 32 has a circumferentially extending outlet 40, on its radially inner circumferentially extending side which supplies the first pressurised fluid onto the curved circumferentially extending Coanda surface 34.

Diametrically opposite, confronting surface portions 31 and 33 of the curved circumferentially extending Coanda surface 34 define a convergent/divergent passage, which has a convergent portion 35, a throat portion 37 and a divergent portion 39. The circumferentially extending outlet 40 is positioned in the convergent portion 35 of the convergent/divergent passage and directs the first fluid towards the throat portion 37.

A supply of liquid (not shown) is arranged to supply liquid to a nozzle 42. The nozzle 42 is arranged upstream of the convergent portion 35 of the convergent/divergent passage and the nozzle 42 is arranged such that a stream of liquid G issuing from the nozzle 42 is positioned between the confronting surface portions 31 and 33.

The first fluid is discharged from the annular chamber 36 through the outlet 40 at high velocity and attaches to the curved circumferentially extending Coanda surface 34 as shown by arrows E in Figure 2. The flow of the first fluid over the circumferentially extending Coanda surface 34 is annular, and causes a second fluid to be entrained towards and between the confronting surface portions 31 and 33 as shown by arrows F. The flow of second fluid is also annular, and is positioned radially inwardly of the flow of first fluid. The stream of liquid G is positioned on the axis of the annular housing 32, and is positioned radially inwardly of the flow of second fluid. The flow of second fluid is positioned between the flow of first fluid and the stream of liquid. Atomisation occurs as the liquid interacts with the flow field generated by the apparatus.

In Figure 3 the apparatus for atomising a liquid is used to atomise a molten metal and the annular housing 32 and nozzle 42 are positioned above a rotating substrate 48. The metallic particles or droplets formed by the passage of the molten metal through the annular housing are deposited onto the rotating substrate 48 to form a metallic article 50. The article 50 may, for example, be a turbine disc for a gas turbine engine.

The first and second fluids are conventionally gases which are inert to the molten metal, for example nitrogen. However gases which are reactive with the molten metal may be used to alter the properties of the molten metal.

Although Figures 2 and 3 show the nozzle 42 and the stream of liquid G on the axis of the annular housing 32, this is not essential. The nozzle 42 may be displaced away from the axis of the annular housing 32, within limits with no detrimental effect on the uniformity of atomisation of the liquid, because the liquid stream is automatically centralised to keep it away from the annular Coanda surface by the flow of first and second fluids into the convergent portion of the convergent/divergent passage.

Similarly if the axis of the annular housing 32 is arranged at orientations other than vertical the uniformity of atomisation of the liquid remains the same, because the liquid stream is automatically centralised. This feature of the circular Coanda surface may be used to control the direction of motion of the liquid particles or droplets leaving the convergent/divergent passage. The annular housing may be mounted on a fixed structure so that the annular housing is free to move to positions in which the axis of the annular housing, or the axis of convergent/divergent passage, is arranged at an angle with respect to the vertical direction. The annular housing may be moved continuously during the atomisation process or periodically to change the direction of travel of the liquid particles or droplets.

A second apparatus 60 for atomising a liquid according to the present invention used to atomise a molten metal, is shown in Figure 4. The apparatus 60 comprises a first housing 62 and a second housing 72. The first housing 62, has one side, which has a first curved Coanda surface 64. The first housing 62 defines a chamber. One or more pipes are arranged to supply a first pressurised fluid into the chamber. The housing 62 has an outlet 66 which supplies the first pressurised fluid onto the first curved Coanda surface 64. The first housing 62, the first curved Coanda surface 64 and the outlet 66 extend linearly. The second housing 72 has one side, which has a second curved Coanda surface 74. The second housing 72 defines a chamber. One or more pipes are arranged to supply a first pressurised fluid into the chamber. The housing 72 has an outlet 76 which supplies the first pressurised fluid onto the second curved Coanda surface 74. The second housing 72, the second curved Coanda surface 64 and the outlet 76 extend linearly. The first and second curved Coanda surfaces 64 and 74 are arranged such that they face each other, and are parallel. The first and second Coanda surfaces are arranged to define a convergent/divergent passage which has a convergent portion 88, a throat 90 and a divergent portion 92. The first and second Coanda surfaces are elongate and extend transversely with respect to the direction of flow of fluid through the passage. The outlets 66 and 76 are positioned in the convergent portion 88, of the convergent/divergent passage and direct the first fluid towards the throat 90.

A tundish 82 contains a supply of molten metal 84, and the tundish 82 has a nozzle 86 at a lower region to discharge molten metal. The tundish 82 is arranged at a higher elevation than the first and second Coanda surfaces 64,74 and the nozzle 86 is arranged such that a stream of molten metal K falling from the tundish 82 is positioned between the confronting Coanda surfaces 64 and 74.

The first fluid is discharged from the chambers through the outlets 66 and 76 at high velocity and attaches to the curved Coanda surfaces 64 and 74 respectively as shown by arrows I. A flow of a second fluid J is entrained towards and between the confronting Coanda surfaces 64,74 by the first fluid. The stream of molten metal K is positioned midway between the Coanda surfaces 64,74. The second fluid flows between the first fluid and the stream of molten metal. The molten metal is atomised to form metallic particles or droplets as it interacts with the flow field generated by the apparatus.

A substrate 94 is positioned below the first housing 62, second housing 72 and the tundish 82. The metallic droplets formed by the passage of the molten metal between the two housings are deposited on the substrate 96 to form a metallic article 96. The substrate 94 may be moved transversely to the direction of flow of the fluid through the convergent/divergent passage.

The embodiment in Figure 4 operates in a similar way to the embodiments in Figures 2 and 3 in that although the liquid stream is shown midway between the two Coanda surfaces, this is not essential. The liquid stream is automatically centralised to keep it away from the two Coanda surfaces by the flow of first and second fluids into the convergent portion of the convergent/divergent passage, to give a more uniform atomisation of the liquid stream.

It may be equally possible to deposit the molten metallic droplets onto an article to coat the article instead of forming an article on a substrate.

The metallic particles produced by the invention may be collected and subsequently processed by well known powder metal techniques to form articles.

The invention is suitable for atomising liquid fuels, for example for gas turbine engines, in such circumstances the first and second fluids are air or oxygen. The invention is also suitable for atomising

water, paint or other surface treatment material.

It may be possible to use other arrangements with two confronting Coanda surfaces to atomise liquids, for example polygonal shapes in which the Coanda surfaces are parallel.

Although the description has referred to the flow passage between the confronting Coanda surfaces having a convergent portion, a throat and a divergent portion, the flow passage may have a convergent portion, a parallel throat portion and a divergent portion, or a convergent portion and a parallel portion, or simply a convergent portion.

The third apparatus 130 for atomising a liquid according to the present invention used to atomise a molten metal, is shown in Figure 5. The apparatus 130 comprises an annular housing 132, the radially inner circumferentially extending side of which has a curved circumferentially extending Coanda surface 134. The annular housing 132 defines an annular chamber 136. A pipe 138 is arranged to supply a first pressurised fluid into the annular chamber 136. The annular housing 132 has a circumferentially extending outlet 140, on its radially inner circumferentially extending side which supplies the first pressurised fluid onto the curved circumferentially extending Coanda surface 134.

Diametrically opposite, confronting surface portions 131 and 133 of the curved circumferentially extending Coanda surface 134 define a convergent/divergent passage, which has a convergent portion 135, a parallel throat portion 137 and a divergent portion 139. The circumferentially extending outlet 140 is positioned in the convergent portion 135 of the convergent/divergent passage and directs the fluid towards the parallel throat portion 137.

Liquid to be atomised is supplied from a nozzle 142. The nozzle 142 is arranged upstream of the convergent portion 135 of the convergent/divergent passage and the nozzle 142 is arranged such that the stream of liquid issuing from the nozzle 142 is positioned between the confronting surface portions 131 and 133. The apparatus operates in a similar way to the embodiments in Figures 2,3 and 4.

The position of the liquid supply nozzle relative to the housing and the flow passage through the housing is not too critical. The liquid supply nozzle may be positioned any suitable distance away from the housing.

It is to be noted that in Figures 2 and 4 the confronting surfaces are curved in the convergent portion and the throat portion of the flow passage, but at a predetermined position beyond the throat the confronting surfaces follow straight line paths. The portions of the confronting surfaces following the straight line paths define a divergent diffuser. In Figure 5, the confronting surfaces are curved in the convergent portion of the flow passage, but at the throat portion the confronting surfaces follow straight line paths. The portions of the confronting surfaces following the straight line paths define a parallel diffuser.

It may be possible for the convergent portion of the flow passage to have a curved section but at a predetermined position the curvature is followed by a straight section which converges to the throat to define a convergent diffuser.

The confronting surfaces may only follow a curved path and may not be provided with sections following straight line paths so that a diffuser is not provided. These curved confronting surfaces may have convergent, throat and divergent portions or simply a convergent portion.

The angle of the diffuser controls the angle of the spray of liquid droplets or particles leaving the flow passage. The length of the diffuser is important in controlling wetting or impingement of the liquid droplets or particles on the confronting surfaces of the flow passage.

It is preferred that the flow passage between the confronting surfaces has only a convergent portion in order to prevent the atomised liquid particles or droplets wetting or impinging on the confronting surfaces of the flow passage. Alternatively the flow passage between the confronting surfaces may be arranged to have a diffuser/divergent portion which prevents the atomised liquid particles or droplets wetting or impinging on the confronting surfaces of the flow passage by selection of a suitable angle of divergence and a suitable length. It is particularly important to prevent molten metal particles or droplets impinging upon the confronting surfaces of the flow passage because they may stick to the surfaces and this may lead to the eventual blocking of the flow passage. Molten metal particles or droplets impinging on the confronting surfaces may pick up impurities from the confronting surfaces of the flow passage, and these impurities may adversely affect the subsequently formed article or coating.

The description has referred to a second fluid being entrained into the flow passage by the flow of first fluid over the confronting Coanda surfaces, in some circumstances the second fluid is the first fluid which has recirculated, and in other circumstances a flow of second fluid into the flow passage is prevented by closing the upstream end of the flow passage except for the supply of the liquid to be atomised.

Claims

1. An apparatus for atomising a liquid comprising a first Coanda surface (31), means (40) to supply a first fluid (E) to the first Coanda surface (31) such that the first fluid (E) flows

along the first Coanda surface (31), liquid supply means (42) to supply liquid characterised in that a second Coanda surface (33) is arranged to confront the first Coanda surface (31), means (40) is arranged to supply the first fluid (E) to the second Coanda surface (33) such that the first fluid (E) flows along the second Coanda surface (33), the first and second confronting Coanda surfaces (31,33) are arranged to define a flow passage (35,37,39) having at least a convergent portion (35), the means (40) to supply the first fluid (E) to the first and second confronting Coanda surfaces (31,33) is arranged to supply the first fluid (E) into the convergent portion (35) of the flow passage (35,37,39) such that the first fluid (E) flows along the first and second confronting Coanda surfaces (31,33) towards the end of the convergent portion (35) of the flow passage having the smaller cross-sectional area (37) and through the flow passage (35,37,39), the liquid supply means (42) is arranged to supply the liquid to the flow passage (35,37,39) such that in use the liquid is atomised to form liquid particles or droplets as it flows through the flow passage (35,37,39).

2. An apparatus as claimed in claim 1 in which a second fluid (F) is caused to flow between the first and second confronting Coanda surfaces (31,33) through the flow passage by the flow of first fluid (E) along the first and second confronting Coanda surfaces (31,33) such that the second fluid (F) flows between the flow of first fluid (E) and the liquid (G).

3. An apparatus as claimed in claim 1 or claim 2 in which the first and second Coanda surfaces (31,33) are arranged to form a second parallel portion of the flow passage immediately downstream of the first portion.

4. An apparatus as claimed in claim 3 in which the first and second Coanda surfaces are arranged to form a third divergent portion of the flow passage immediately downstream of the second portion.

5. An apparatus as claimed in claim 1 or claim 2 in which the first and second Coanda surfaces (31,33) are arranged to form a second divergent portion (39) of the flow passage immediately downstream of the first portion (35).

6. An apparatus as claimed in any of claims 1 to 5 in which the first and second confronting Coanda surfaces (64,74) are elongate in a direction transverse to the direction of the fluid flow (E).

7. An apparatus as claimed in claim 6 in which the first and second confronting Coanda surfaces (64,74) are parallel linear surfaces.

8. An apparatus as claimed in any of claims 1 to 5 in which the first and second confronting Coanda surfaces are parallel linear Coanda surface portions of a single polygonal Coanda surface.

9. An apparatus as claimed in any of claims 1 to 5 in which the first and second confronting Coanda surfaces (31,33) are surface portions of a single circumferentially extending Coanda surface (34).

10. An apparatus as claimed in any of claims 1 to 9 in which the apparatus is movable such that the axis of the flow passage (35,37,39) is movable between a first position and a second position in which the axis is arranged at an angle with respect to the first position to control the direction of flow of the liquid particles or droplets.

11. An apparatus as claimed in claim 10 in which the axis of the flow passage (35,37,39) is arranged vertically in the first position.

12. An apparatus as claimed in any of claims 1 to 11 in which the liquid supply means (42) is a supply of molten metal.

13. An apparatus as claimed in claim 12 in which a substrate (48) is arranged to receive the metallic droplets leaving the flow passage (35,37,39), the metallic droplets are deposited onto the substrate (48) to produce a metallic article (50), the metallic droplets are in a liquid or partly solidified state when deposited on the substrate (48).

14. An apparatus as claimed in claim 12 in which an article is arranged to receive the metallic droplets leaving the flow passage (35,37,39), the metallic droplets are deposited onto the article to produce a metallic coating, the metallic droplets are in a liquid or partly solidified state when deposited on the article.

15. An apparatus as claimed in any of claims 12 to 14 in which the means to supply the first and second fluids (E,F) are supplies of gases inert with respect to the molten metal.

16. An apparatus as claimed in any of claims 12 to

14 in which the means to supply the first and second fluids (E,F) are supplies of gases reactive with respect to the molten metal.

17. An apparatus as claimed in claim 1 in which the liquid supply means (42) is a supply of water, paint or any surface treatment material.

18. An apparatus as claimed in claim 1 in which the liquid supply means (42) is a supply of liquid fuel.

19. An apparatus as claimed in claim 18 in which the means to supply the first and second fluids (E,F) are supplies of air or oxygen.

20. A method for atomising a liquid comprising directing a first fluid into a convergent portion of a flow passage to flow along first and second confronting Coanda surfaces defining the flow passage towards an end of the convergent portion having the smallest cross-sectional area, supplying a liquid to the flow passage such that the liquid is atomised to form liquid particles or droplets as it flows through the flow passage.

21. A method as claimed in claim 20 in which a second fluid is caused to flow between the first and second confronting Coanda surfaces through the flow passage by the flow of first fluid along the first and second confronting Coanda surfaces such that the second fluid flows between the flow of first fluid and the liquid.

22. A method as claimed in claim 20 in which the liquid is a molten metal.

23. A method as claimed in claim 22 comprising depositing the metallic droplets leaving the flow passage onto a substrate to produce a metallic article, the metallic droplets are in a liquid or partly solidified state when deposited on the substrate.

24. A method as claimed in claim 22 comprising depositing the metallic droplets leaving the flow passage onto an article to produce a metallic coating, the metallic droplets are in a liquid or partly solidified state when deposited on the article.

25. A method as claimed in claim 20 in which the first fluid is inert with respect to the molten metal.

26. A method as claimed in claim 21 in which the second fluid is inert with respect to the molten metal.

27. A method as claimed in claim 22 in which the molten metal is a single metal or an alloy.

28. An article as made by the method as claimed in claim 23.

29. An article having a metallic coating as made by the method as claimed in claim 24.

30. A method as claimed in claim 22 comprising depositing the metallic droplets leaving the flow passage to produce metallic powder for use in power metallurgy.

31. An article made from metallic powder produced by the method as claimed in claim 30.

Fig.1.

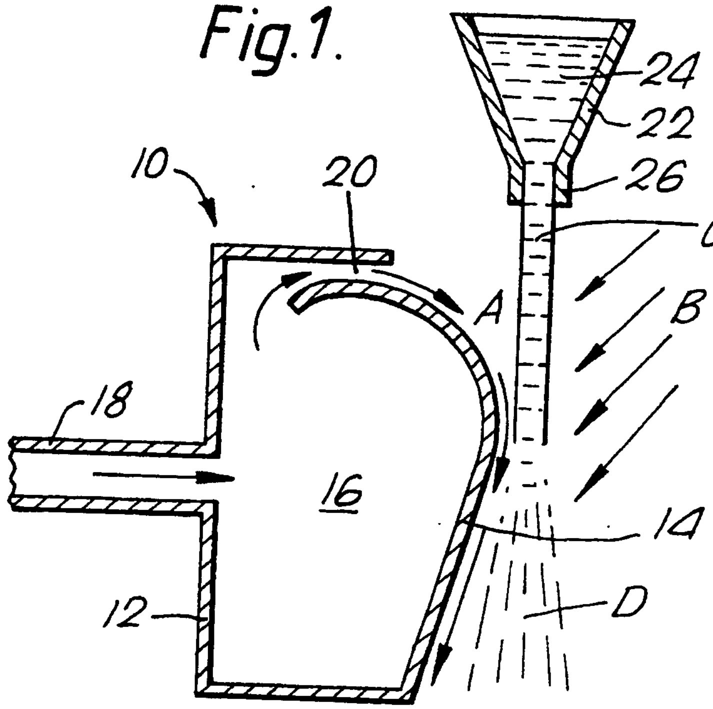

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Fig.2.

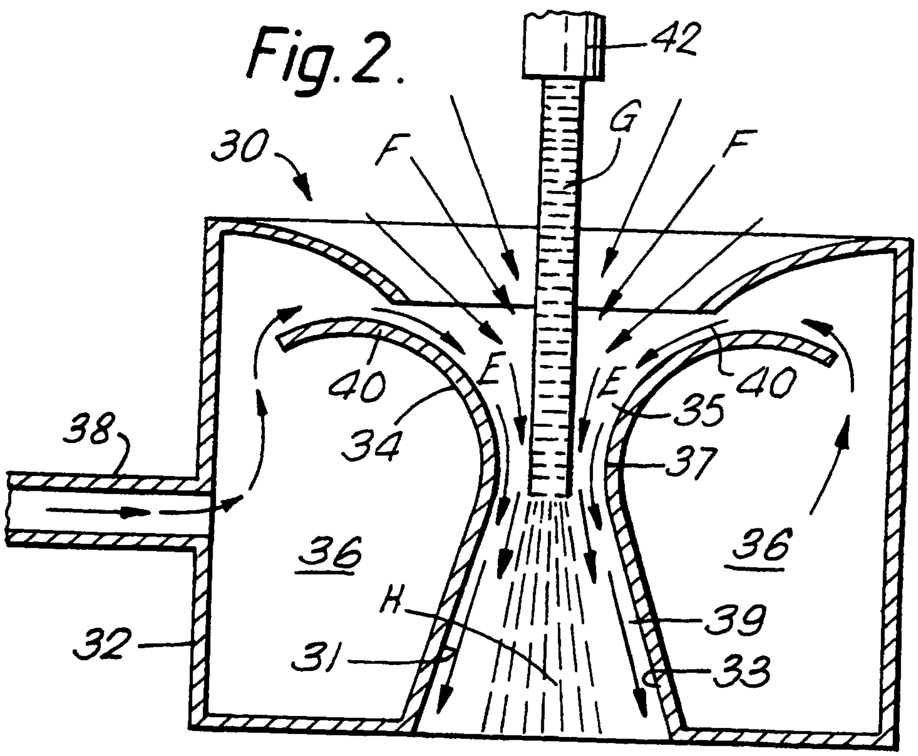
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Fig.3.

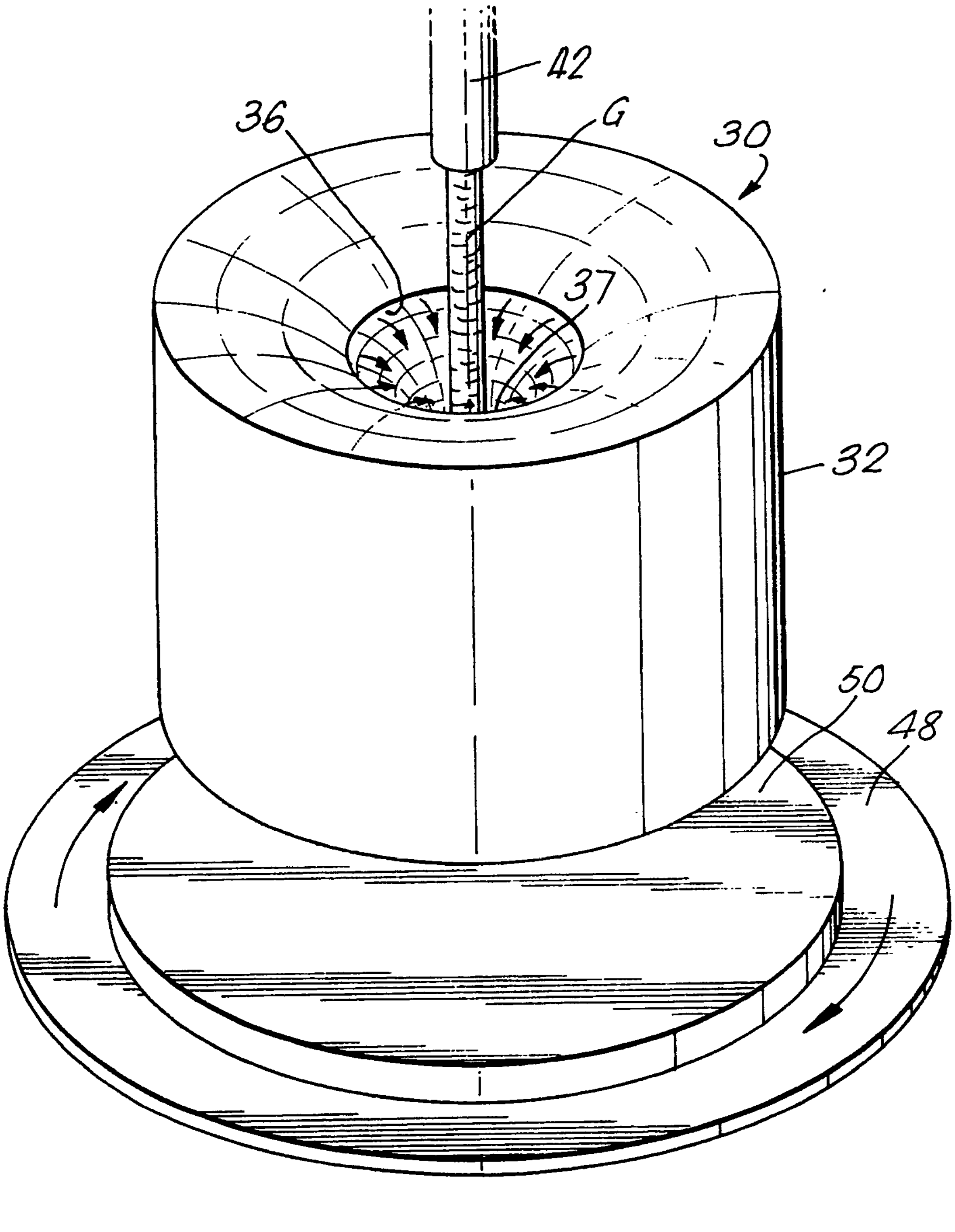

Fig.4.

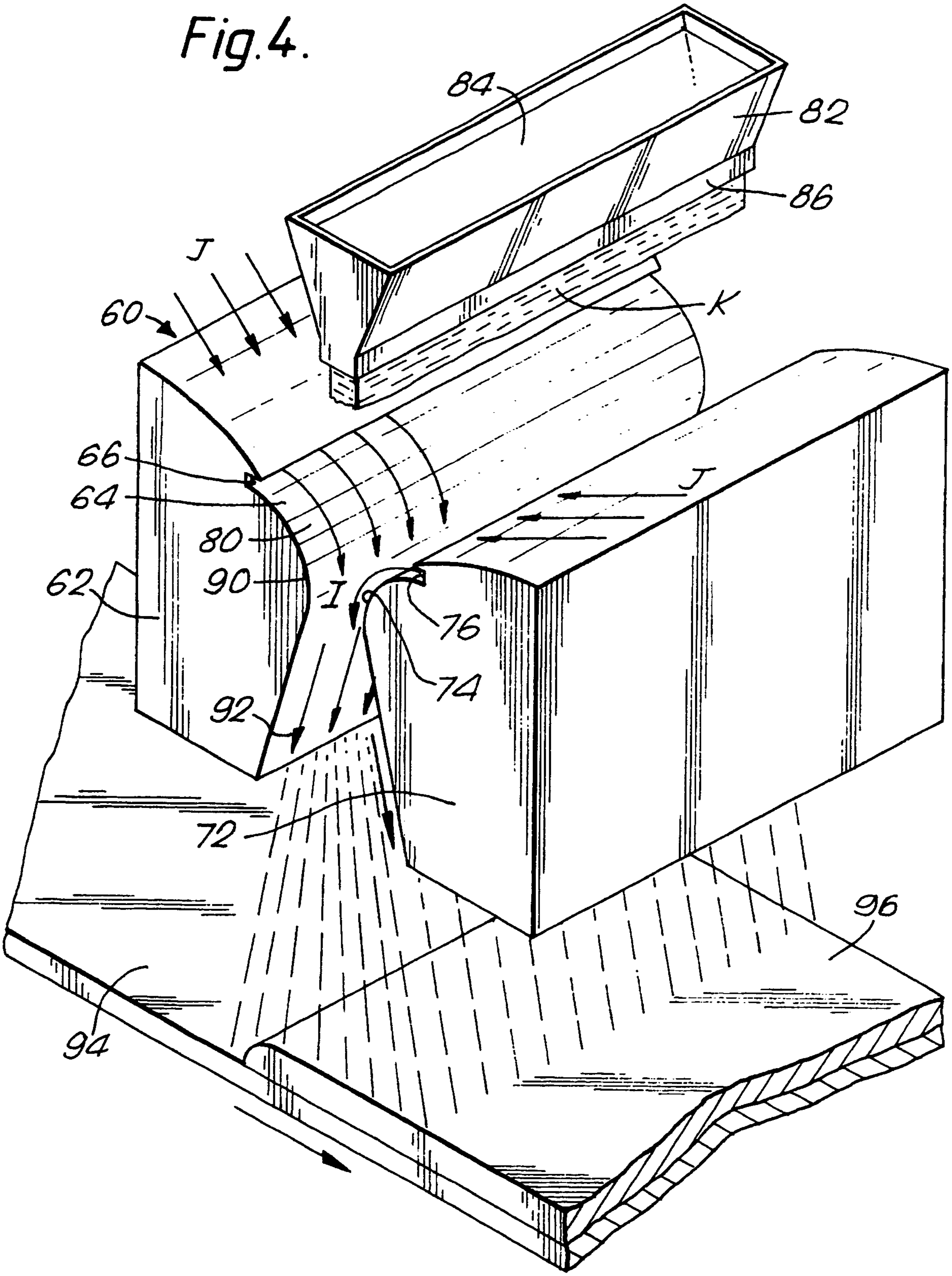

Fig. 5.

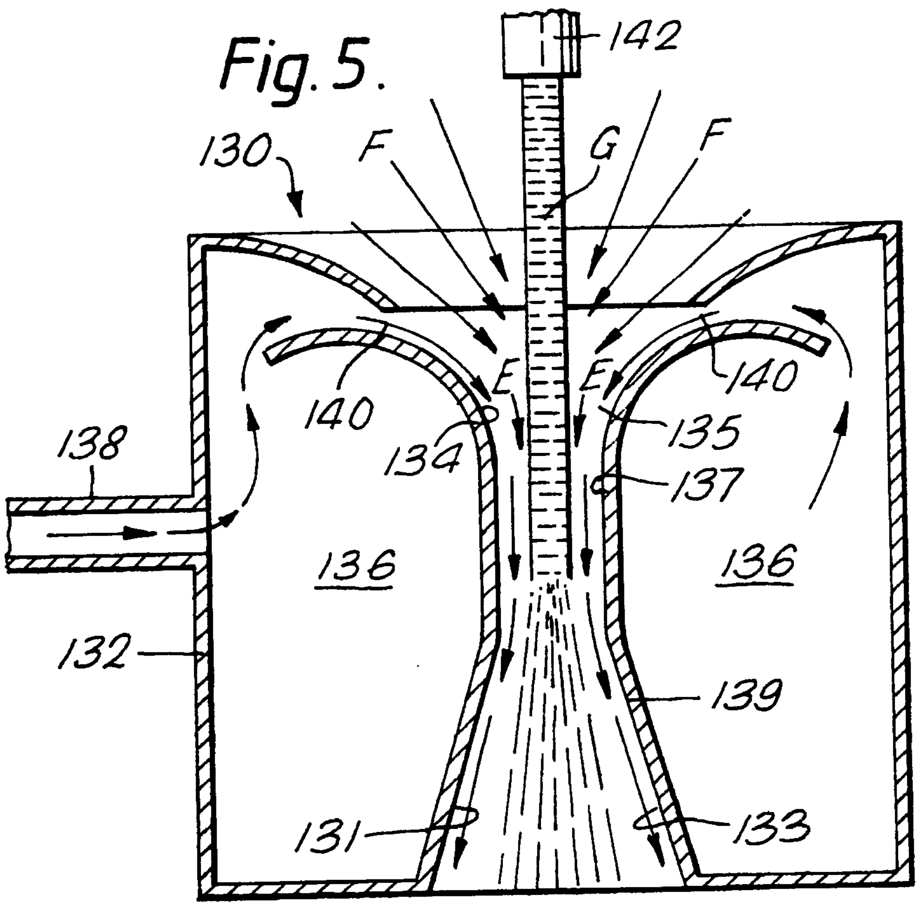

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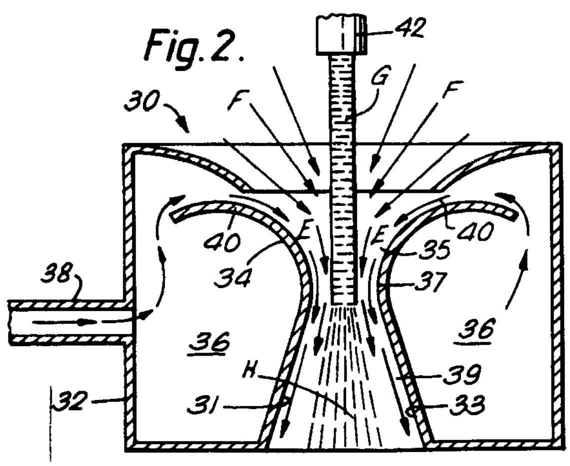
Fig. 2.



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EUROPEAN SEARCH REPORT

Application Number

EP 91 30 0236

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	BE-A-507 185 (SEBAC NOUVELLE SA) * page 1, line 1 - line 4 * * * page 4, line 14 - line 26 * * * page 5, line 4 - line 15 * * * page 5, line 46 - line 58; figures 1,4 * *	1-4,9, 17-21	B 05 B 7/00 B 05 B 7/04 C 23 C 4/12
Y		5-8, 12-15, 22-31	
Y	GB-A-2 146 662 (TELEDYNE INDUSTRIES INC.) * claims 1-30; figures 1,2 * *	5-8, 12-15, 22-31	
X	PATENT ABSTRACTS OF JAPAN vol. 13, no. 224 (C-599)(3572) 24 May 1989 & JP-A-1 034 458 (MITSUI ENG. & SHIPBUILD CO LTD) 3 February 1989 * abstract * *	1-3,9, 17-21	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 05 B
C 23 C

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	08 January 92	BREVIER F.J.L.

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